

RESEARCH INTO SERVICE TREE (*Sorbus domestica* L.) POPULATION IN EASTERN SERBIA

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All fruit tree populations along with the service tree (*Sorbus domestica* L) population offer a wealth of diverse genetic material which is essential for the selection and creation of new cultivars and rootstocks. The main objective of the study was to evaluate the service tree population in Eastern Serbia in order to single out good selections whose fruit can be used fresh or processed in the human diet, as well as genotypes suitable for the development of new cultivars and rootstocks. The service tree population was analyzed for tree age, tree size and major fruit properties (shape, size and soluble solids content). Small-sized, medium to large and large fruits ranging in weight from 7.5-9.8 g, 10.3-18.6 g and 21.7-25.6 g were found in 52.3%, 41.1% and 6.60% trees, respectively, within the test population. Fruit length was 18.6-33.4 mm, fruit thickness 22.8-37.4 mm, stalk length 1.8-3.7 mm, soluble solids content 15.7-22.5%. The study also presents

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properties of some superior trees which require greater attention in terms of propagation, collection activities and commercial cultivation.

Key words: fruit property, population, service tree

INTRODUCTION

The service tree (*Sorbus domestica* L.) is a rare wild fruit tree. It is sporadically found under the agroenvironmental conditions in Serbia. It grows as solitary trees, rarely in groups, on meadows or in low height oak (*Quercus petraea*), hornbeam (*Carpinus betulus*) and Turkey oak (*Quercus cemis*) forest communities, but it does not thrive in beech (*Fagus moesiaca*) and pine (*Pinus nigra*) stands. Its fruit abounds in vitamins (B₂, A and C) and mineral substances, and has a high nutritional and prophylactic value. The service tree (*Sorbus domestica* L.) contains strong natural antioxidants with beneficial health properties (TERMENTZI, 2006). BUKVIĆ *et al.* (2007) report that the service tree is practically not susceptible to parasite and pest attacks, and underline the high nutritional, dietetic and therapeutic value of its fruit which is consumed fresh or processed into different food products.

The fruit of the service tree is consumed when softened (overripe) or made into jams, jellies, compotes, juices or fruit wine. It can be preserved by drying in order to be consumed dried or used to make teas. Owing to its medicinal properties, the fruit is used in folk medicine (against dysentery and kidney diseases), as well as to improve memory and concentration. The service tree produces high-value timber that is used for furniture (veneer), instrument and tool construction.

The service tree has the most modest growing requirements among all fruit trees. It shows good performance on dry calcareous soils, notably on deep carbonate soils in east- and southeast-facing locations. It is a heliophyte, found at altitudes of 300-700 m. Its tree can reach over 100 years of age, exhibiting high vigor and good yield potential (100-300 kg/tree). Despite the numerous positive traits and the potential for the production of food having a high biological value, service trees have been given only minor importance.

In the field of service tree selection, major results are reported by MIKO and GAŽO (2004), BRINDIZA *et al.* (2009) and PAGANOVA (2007) in Slovakia and VEGVARI and PALLAGI (2000) in Hungary. Few authors in Serbia have dealt with the service tree as a fruit tree species. The service tree population and its selection have been the subject matter of research by NIKOLIĆ *et al.* (1996) in Central Serbia and by MRATINIĆ and KOJIĆ (1998) and BALANININ *et al.* (2006) in Eastern Serbia.

Due to the above reasons, the objective of this study was to conduct research into the existing service tree populations in Eastern Serbia in order to single out good selections and promote their commercial-scale cultivation.

MATERIALS AND METHODS

The study was conducted in a wider region of Eastern Serbia (Timocka Krajina) over a five-year period from 2002-2006. Due to its geographical location, Eastern Serbia belongs to the continental climatic zone, characterized by high temperatures, moderate rainfall and frequent dry periods. Nevertheless, the service tree is successfully grown in the region due to its high drought and stress tolerance. Average annual rainfall was 579.8 ± 101.6 mm during the research period and 373.1 ± 95.7 mm during the growing season. Mean annual air temperatures were $11.2 \pm 0.82^{\circ}\text{C}$ and $17.2 \pm 0.68^{\circ}\text{C}$ during the growing season. Calcareous soils are the dominant type of soils. The service tree occurs in the lowlands, uplands and highlands of Eastern Serbia. The test trees ranged from 50 to 100 years of age.

The research involved individual outstanding trees that stood out for their vitality, high stable yields and good fruit properties. Fruit size, shape and soluble solids content were determined in the fruit. Major properties of 5 selections singled out for the experiment and potentially used for collection and commercial production purposes are also presented.

The fruits were harvested in September, at the stage of maturity, from over 200 trees. Fruit weight was determined using a Mettler balance, fruit length, fruit thickness and stalk length were measured by a calliper, and soluble solids content was evaluated using a refractometer. According to the criteria set, the fruits were grouped into three classes: small fruits (up to 10 g), medium to large fruits (10 - 20 g) and large and very large fruits (over 20 g). Tree diameter was determined by measuring tree circumference. Tree height was measured using a forestry tool.

RESULTS

The test trees within the service tree population reached a height of 15-20 m, with a trunk diameter of 55-165 cm at the base. Within the population, 52.3% of the trees had small fruits weighing between 7.5 and 9.8 g, 41.1% of the trees yielded medium to large fruits ranging in weight from 10.3-18.6 g and 6.60% of the trees gave large and very large fruit of 21.7-25.6 g weight. Fruit length, fruit thickness and stalk length were 18.5-33.4 mm, 22.3-37.4 mm and 1.8-3.7 mm, respectively. The soluble solids content at the time of sampling under *in situ* conditions was within the range 15.7-22.5% (Table 1).

Apple-shaped fruits predominated in 62.4% of the test trees, whereas pear-shaped fruits were produced by 37.6%. The fruit skin was mostly thin, smooth or slightly rough, with a whitish, firm, acid, astringent mesocarp. The skin was yellow in color with a slight or pronounced red blush on the sun-exposed side. The mesocarp of overripening fruits became soft, sweet and aromatic, offering a pleasant refreshing taste.

The trees in the test service tree population yielded their first fruit relatively late, after twenty years of age, with full productivity occurring between 30 and 40 years of age. The trees produced quite non-uniform yields, ranging from 20 to 200 kg/tree. It is noteworthy that yield stability under the agroenvironmental conditions in Serbia is induced by late spring frosts and dry periods during the growing season.

Table 1. Fruit properties of the service tree population

Fruit class	Weight (g)	Percentage (%)	Fruit length (mm)	Fruit thickness (mm)	Stalk length (mm)	Soluble solids (%)
> 10	7.5-9.8	52.3	18.6-21.5	22.8-27.3	1.8-2.6	15.7-21.8
10.1-20.0	10.3-18.6	41.1	21.7-33.6	23.6-32.5	2.5-3.4	17.4-22.1
< 20.1	21.7-25.6	6.6	23.6-33.4	28.9-37.4	3.2-3.7	19.3-22.5

Superior trees that can play an important role in further service tree collection and propagation work were recorded and singled out. The promising selections presented in Table 2 had the following properties: fruit weight 14.2-25.6 g, fruit length 26.3-36.2 mm, fruit thickness 25.7-34.8 mm and stalk length 3.6-4.4 mm. The soluble solids content at harvest ranged from 17.7.-24.8%, and increased by 2.1 to 7.2% during overripening. The fruits were apple-shaped in 3 test selections and pear-shaped in 2 selections. Apple-shaped fruits had a 3.7 g higher weight, and a 3.4% and 3.0% higher soluble solids content in fresh and overripe fruits, respectively, as compared to pear-shaped fruits.

Table 2. Properties of promising (superior) service tree selections

Selection number	Fruit weight (g)	Fruit length (mm)	Fruit thickness (mm)	Stalk length (mm)	Fruit shape	Soluble solids (%)	
						Fresh fruit	Overripe fruit
1	14.2	26.3	27.4	4.4	Apple-shaped	18.7	21.6
2	14.8	37.4	25.8	4.1	Pear-shaped	17.7	19.8
3	19.6	31.4	27.7	4.4	Pear-shaped	19.4	23.4
4	22.9	33.6	34.8	3.9	Apple-shaped	22.1	25.2
5	25.6	36.2	32.4	3.6	Apple-shaped	24.8	27.0

DISCUSSION

The service tree is a nutritious decorative deciduous pome fruit that has been highly neglected, being given only minor importance and used only for species conservation purposes, regardless of its good traits. Being propagated by the

generative method through seeds, it is found sporadically in the wild state in farmsteads or in forests, meadows, pastures and other similar biocenoses.

Under the existing climatic and soil conditions, the region selected for the present research into the service tree population is suitable for its cultivation, which is in agreement with the report of MRATINIĆ and KOJIĆ (1998). These authors state that the Eastern Serbian region is favourable for service tree growth due to the predominance of calcareous soils and service tree preference for dry soils over moist soils. Eastern Serbia belongs to a continental climatic zone which is quite different from the climate of the other Serbian regions, being bordered by mountains on the east, south and west, and open towards Vlačka Valley on the north. Marked differences are observed in terms of temperature fluctuations; rainfall amounts and distribution, occurrence of late spring frosts and dry periods, and sudden dormancy-to-growth transitions (DODIG *et al.* 2006). Eastern Serbian regions are characterized by moderate rainfall and high air temperatures. MILETIĆ *et al.* (2007) report an average range of 303.3 - 781.7 mm and 205.2 - 516.3 mm rainfall during the year and growing season, respectively. The mean air temperature in the region was 9.9 - 13.0 °C over the year and 15.7 - 18.5 °C during the growing season. Although suitable for service tree cultivation, the above agroenvironmental conditions have a depressive effect on fruit yield, fruit size and fruit weight during the years with extreme drought during the summer months (June, July, August) i.e. during the intensive growth and fruit maturity stage.

The results on fruit weight, fruit length, fruit thickness and soluble solids content comply with those reported by other authors.

MIKO (2001) and MIKO and GAŽO (2003; 2004) reported the following values for the service tree population: 3.0 - 21.8 g fruit weight, 16.0 - 33.0 mm fruit length, and 18.0 - 38.0 mm fruit width. The results of the present experiment are also comparable to those of BRINDZA *et al.* (2009) who determined 4.91-18.6 g for fruit weight, a range of 19.8-36.2 mm for fruit length and 18.9-32.6 mm for fruit width. DRVODELIC *et al.* (2009) observed service tree fruits 3.68-17.1 g in weight, 22.0-25.7 mm in length and 24.5-27.3 mm in width. BALANININ *et al.* (2006) found service tree fruits to be 17.5-35.1 mm long and 15.5-24.9 mm wide. In a study by NIKOLIĆ *et al.* (1998), the service tree biotypes singled out in Central Serbia had a fruit weight of 9.6-24.5 g, fruit length of 19.7-36.1 mm, fruit width of 25.1-36.6 mm, stalk length of 2.6-5.5 mm and soluble solids content of 17.5-22.0%.

The test trees reached a height of 15 - 20 m and basal trunk diameter of 55 - 165 cm, which is in agreement with ROTACH (2003) and DRVODELIC *et al.* (2009).

It is noteworthy that each tree within the population showed specific properties due to its generative propagation. The trees differed in terms of their morphology and genetics, as also confirmed by BIGNAMI (2000), MIKO and GAŽO (2004) and BRUS *et al.* (2011), who observed high variability in the service tree. The service tree is a relatively rare species of scarce sporadic distribution, generally occurring as isolate trees or small groups of trees, with the genetic drift due to inbreeding being present. This leaves an important mark on the population, making it exceptionally specific.

Apart from the above, the agroenvironmental growing conditions had a direct effect on the biological, pomological and technological traits of both the tree and the fruit, with the results stemming from the combined effect of all of the above factors.

CONCLUSION

The service tree deserves substantial attention, not only with respect to its conservation as a wild fruit tree species in meadows, pastures and forests, but also with respect to fruit production.

Given the fact that the service tree is practically not susceptible to parasite and pest attacks, its fruit can be used as a valuable raw material for the production of food having a high biological value.

The test trees singled out from the native population gave an average fruit weight, fruit length, fruit thickness and soluble solids content of 16.6 g, 26.0 mm, 30.1 mm and 19.1%, respectively.

The promising selections singled out for the research were found to have the following properties: average fruit weight 19.4 g, fruit length 33.0 mm, fruit thickness 29.6 mm, stalk length 4.08 mm and soluble solids content 20.5% in fresh fruits and 23.4% in overripe fruits. The data obtained in this study show good fruit properties of the test selections and suggest the necessity for their conservation towards further propagation, collection work and commercial cultivation.

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REFERENCES

- BIGNAMI C. (2000): Service tree (*Sorbus domestica* L.). Description and use of service tree Viterbo. Italy Informatore-Agrario 56. pp. 55-58.
- BRINDZA, J., J.ČEVERNIKOVA, D.TOTH and J.SAJBIDOR (2009): Unutilized Potential of True Service Tree (*Sorbus domestica* L.). Proceedings, Acta Horticulturae, 806: 717-726.
- BALANININ, D., T.MIKIĆ, S.BOGDAN and S.OROVIĆ (2006): Variability of some morphological characters of service tree (*Sorbus domestica* L.) fruits and seed in east Serbia. Contemporary agriculture, 55, 5: 146-152
- BUKVIĆ, B., E. MRATINIĆ and M.FOTIRIĆ (2007): Quality of wild fruits from the area of the Djerdap gorge and possibility of their. Journal of Scientific Agricultural Research, 68, 3: 53-63.
- BRUS, R., D.BALLIAN, F.BOGUNIC, M.BOBINAC and M.IDŽOJTIĆ (2011): Leaflet morphometric variation of service tree (*Sorbus domestica* L.) in the Balkan Peninsula. Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology: Official Journal of the Societa Botanica Italiana 145 (2), 278-285.
- DODIG, D., P.SPASOV and R. MILETIĆ (2006): The Occurrence of Drought and its Effects on plant Production in Eastern Serbia. Acta Agriculturae Serbica, 11 (21), 45-51.

- DRVODELIĆ, D., M.ORSANIĆ and T.JEMRIĆ (2009): Morphological characteristics of fruits and seed of the service tree (*Sorbus Domestica* L.). Croatian. Institute of forestry 44 (1), 5-15.
- MIKO, M. (2001): Genofond ovocnjih druhov. pp. 54-59.
- MIKO, M. and J.GAŽO (2003): Morfological diversity of *Sorbus domestica* at the level of fruits and leaves in the selected localities of Slovakia. Biologia, 58, 35-39.
- MIKO, M. and J. GAŽO (2004): Morphological and Biological Characteristics of Fruit and Seed of the Service Tree. Journal of Fruit and Ornamental Plant Research, 12, 139-146.
- MILETIĆ, R., M. MITROVIĆ, N. MITIĆ and R.NIKOLIĆ (2007): The influence of meteorological factors on major fruit properties of hazelnut cultivars. Contemporary agriculture, 56, 6: 175-181.
- MRATINIĆ, E. and M. KOJIĆ (1998): Wild fruit species of Serbia. ARI „Serbia“, Serbia, Belgrade.
- NIKOLIĆ, M., D.OGAŠANOVIĆ and R.CEROVIĆ (1998): Selection of service tree biotypes, Journal of Yugoslav Pomology, 32 (121-122), 27-35.
- NIKOLIĆ, M., D.OGAŠANOVIĆ and M. STANISAVLJEVIĆ (1996): Selection of Service tree (*Sorbus domestica* L.) and selected types. Eukarpija Symposium on Fruit Breeding and Genetics, Acta Horticulturae, 484, 101-104.
- PAGANOVA, V. (2007): Generative Reproduction of *Sorbus domestica* L. As a Limiting Factor of its Wider Utilization in Conditions of Slovakia. Population of Ornamental Plants., 7, (4), 199-203.
- ROTACH, P. (2003): Technical Guidelines for genetic conservation and use for service tree (*Sorbus domestica*). EUFORGEN, International Plant Genetic Resources Institute, Rome, Italy. p. 6.
- TERMENTZI, A., P. KEFALAS and E. KOKKALOU (2006): Antioxidant activities of various extracts and fractions of *Sorbus domestica* fruits at different maturity stages. Food Chemistry, 98, 599-608.
- VEGVARI, G. and M. PALLAGI (1994): The sorb apple. Horticultural Science, 26 (2), 56-66.

**IZUČAVANJE POPULACIJE OSKORUŠE (*Sorbus domestica* L)
NA PODRUČJU ISTOČNE SRBIJE**

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Populacije svih voćnih vrsta, uključujući i populaciju oskoruše (*Sorbus domestica* L) predstavljaju bogatstvo različitog genetičkog materijala, nezaobilaznog u selekciji i stvaranju novih sorti i podloga. Osnovni cilj istraživanja bio je proučavanje populacije oskoruše na području istočne Srbije, radi odabiranja dobrih selekcija čiji plodovi mogu da se koriste u ishrani, sveži ili prerađeni, i genotipova pogodnih za stvaranje novih sorti i podloga. U populaciji je ocenjivana starost i dimenzije stabala i važnije osobina plodova oskoruše (oblik, krupnoća i sadržaj ukupno rastvorljivih suvih materija). Proučavana populacija odlikovala se stablima starosti od 50 do 100 godina. Zastupljenost sitnih plodova mase od 7,5-9,8 g bila je u 52,3% stabala, srednje krupnih od 10,3-18,6 g u 41,1% stabala i krupnih od 21,7-25,6 g u 6,60% stabala. Visina plodova kretala se od 18,6-33,4 mm, debljina od 22,8-37,4 mm, dužina peteljke od 1,8-3,7 mm, dok je sadržaj ukupno rastvorljivih suvih materija iznosio od 15,7-22,5%. U radu su prikazane i osobine pojedinih superiornih stabala, koja zaslužuju veću pažnju u cilju razmnožavanja, kolekcionisanja i komercijalnog gajenja. Izdvojene perspektivne selekcije odlikovale su se prosečnom masom plodova od 19,4 g, visinom od 33,0 mm, debljinom od 29,6 mm, dužinom peteljke od 4,08 mm i sadržajem rastvorljivih suvih materija u svežim plodovima od 20,5%, a u gnjilim od 23,4%.

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